

PICTURE OF THE MONTH

A WSR-57 Radar Presentation of Anomalous Propagation of Superrefraction Type

WOODROW W. LENNON and CLYDE P. THOMAS
WBO, Wilmington, N.C.

When synoptic conditions are such that anomalous propagation is possible, it becomes necessary for radar operators to carefully evaluate questionable echoes to separate precipitation from ground returns. While the case presented here is fairly clear-cut, it is sometimes difficult to evaluate properly all echoes in a large presentation.

Anomalous propagation caused by superrefraction of the radar beam occurred during the early morning of June 6, 1969. Superrefraction means that the curvature of the radar beam is greater than normal, resulting in an extraordinary display of ground targets (Battan 1959). Superrefraction occurs when there is an increase of temperature and/or decrease of moisture with height. In this case, a stable dry air mass and radiation cooling created the proper conditions over the continent, while the warm Gulf Stream under the same air mass triggered convective precipitation just off shore.

Figure 1 shows that the radar beam was trapped near

the earth's surface along the eastern seaboard of the United States from Folly Beach, S.C., northward to at least Wallops Island, Va., the maximum range of the radar display.

Figure 2 is a radar overlay which outlines the precipitation pattern illustrated in figure 1. Note that the western edge of the precipitation extends from Charleston, S.C., to just south of Cape Fear to 30 n.mi. south of Cape Lookout. This illustrates that the rather stable air mass near the coastline and over land became unstable a short distance from the coast with thundershowers occurring over the water. The tops of the thundershowers were generally 25,000 ft, and the cells were moving toward the northeast at 10 kt.

Figure 3 is the surface chart for 0700 EST on June 6, 1969. An inverted trough of low pressure extends from Florida northward, just off shore, near the southeastern coast of the United States. The winds are light with a slight onshore component. Surface dew points are high

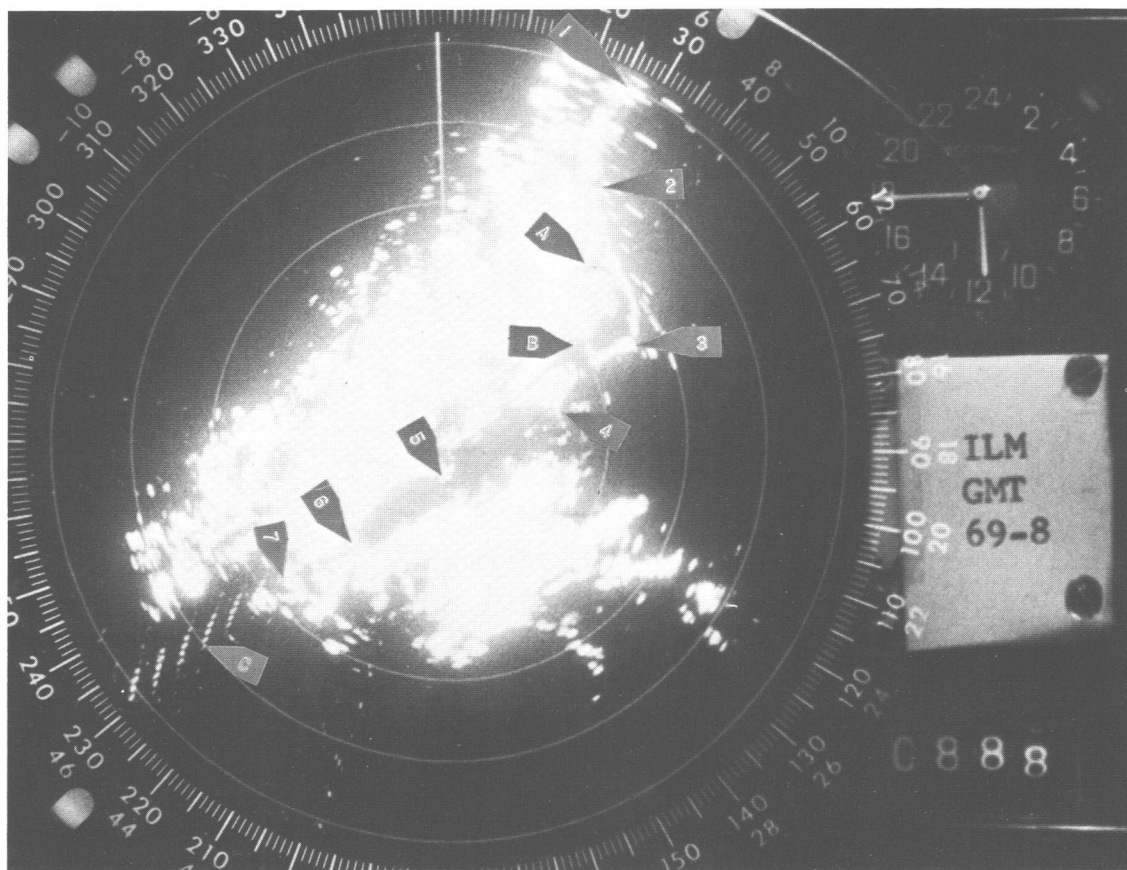
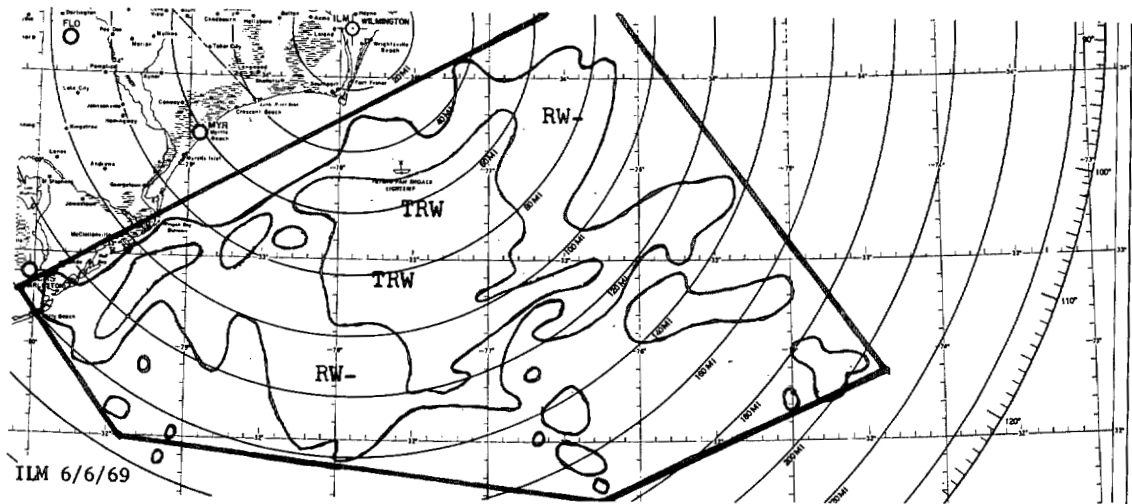


FIGURE 1.—Time lapse frame taken of the WBO, Wilmington, N.C., WSR-57 radar repeater scope on the morning of June 6. A Fairchild recording camera was used. The aperture setting was f/11, and the film was 35 mm Eastman Plus-X, type 4231. (Mention of commercial products does not constitute an endorsement.) (1) Wallops Island, (2) Cape Henry, (3) Cape Hatteras, (4) Cape Lookout, (5) Cape Fear, (6) Winyah Bay Entrance, (7) Folly Beach, (A) Albemarle Sound, (B) Pamlico Sound, and (C) Interference WSR-57 Radar, Charleston, S.C.



1143Z AREA 0 TRW/NC 78/80 120/210 150/175 210/155 232/145 CELLS 2210 MAX TOP 250 AT 202/97

FIGURE 2.—Radar overlay outlining the precipitation pattern illustrated in figure 1.

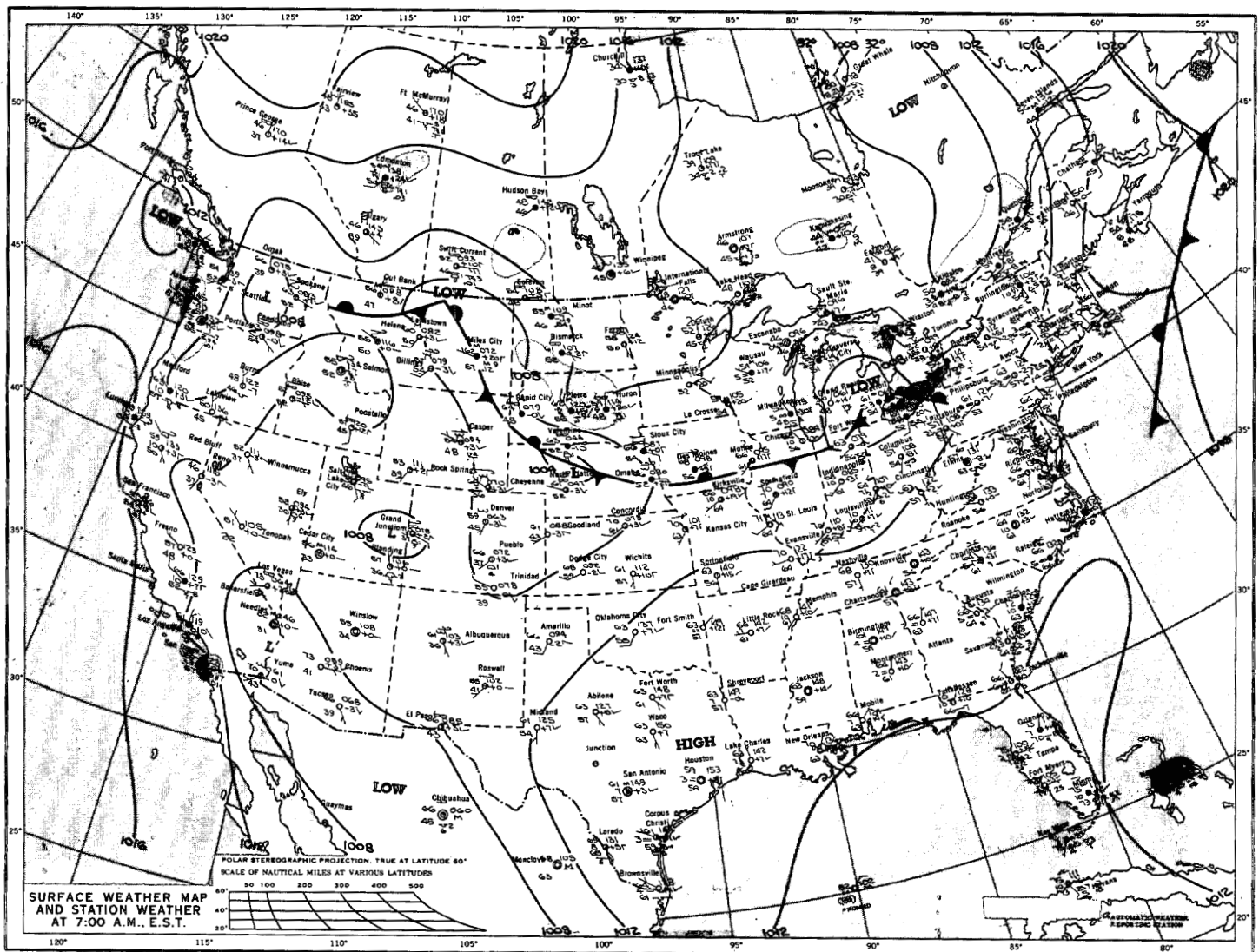


FIGURE 3.—Surface chart for 0700 EST on June 6, 1969.

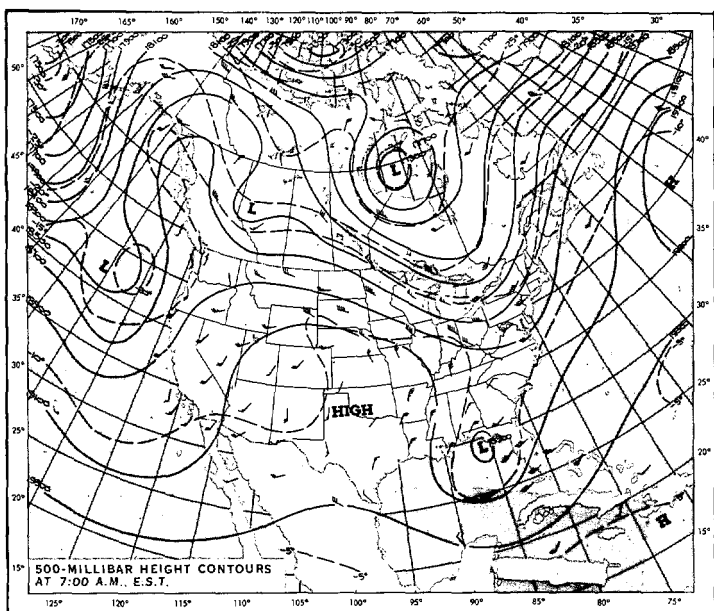


FIGURE 4.—The 500-mb height contours for 0700 EST on June 6, 1969.

with the temperature-dew-point spread ranging from 0° to 3° for the area of interest, indicating a very stable low-level inversion with a high moisture content near the surface.

Figure 4 is the corresponding 500-mb chart. There is a very weak trough to the west of the area of interest, and the flow is light and complex due to a well-defined trough to the north and a cut-off Low over the Florida Panhandle.

The area under consideration is very conducive to anomalous propagation because of the numerous swamps, bays, and marshlands along the coastal area and inland.

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REFERENCE

Battan, Louis J., *Radar Meteorology*, The University of Chicago Press, 1959, 161 pp., (see chapter 3, pp. 14-23).